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use of it in support of their contention of having produced in the chicken a serum lytic for the eye lens of the rabbit, with which results of great biological significance were obtained.

The serum of chickens which had been treated with rabbit lens was injected into the circulation of pregnant rabbits. A few of the young of these rabbits had an eye defect which was passed on to succeeding generations. It was contended that the eye defect was in all probability due to the cytolytic action of the chicken serum since chickens are known to be good cytolsin (hemolysin) producers.

We have treated chickens with the red corpuscles from a number of animal species. In no case was any marked increase in the lytic properties of the serum from the treated birds evident. It was found in fact that fresh chicken serum renders rabbit corpuscles non-antigenic for guinea pigs, which accounts for the failure to produce any marked increase in the sensitizer content of the chicken.

In the light of our observation on the production of hemolysins in the chicken, it seems improbable that Guyer and Smith produced in this species a serum lytic for the eye lens of the rabbit. At least the conclusion that cytolsins must have been formed in the chickens treated with the rabbit lenses because of the readiness with which this species produces cytolytic sera, is not tenable.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE TUCSON MEETING OF THE SOUTHWESTERN DIVISION

THE second annual meeting of the Southwestern Division of the American Association for the Advancement of Science was held at the University of Arizona on Thursday, Friday and Saturday, January 26, 27 and 28, 1922. The meeting was opened by President A. E. Douglass in the chair, who, after a welcome and announcements, proceeded with the papers of the physical science

section in open meeting. These were followed by biological papers in the afternoon. In the evening the president's address was given upon the subject, "Some aspects of the use of annual rings of trees in the study of climate." This meeting constituted the formal opening, with addresses of welcome from the acting mayor of Tucson, the president of the Chamber of Commerce, and the acting president of the university. These were responded to by Dr. E. C. Prentiss, the chairman of the executive committee of the Southwestern Division, who was followed by Dr. D. T. MacDougal, introducing the speaker of the evening. This address was followed by the reception to the visiting members given by the Faculty Club of the University of Arizona.

On Friday morning a special reception was given to Señor Ing. Ignacio Salas and his secretary, Señor H. Irigoyen, representatives of the minister of public works of the Mexican government. These guests were introduced by Dr. D. T. MacDougal, general secretary of the American Association. They responded by speeches in Spanish and in English.

The papers of Friday morning dealt with the social sciences, including history and archeology.

The biological papers were continued at 1:45 P.M., and at 2:45 Dr. Henry B. Ward, of the University of Illinois, gave a lecture entitled "The struggle between man and wild life in North America" before a joint meeting of the Sigma Xi Club of the University of Arizona with the Southwestern Division, to which also a special invitation had been extended to the Pima County Teachers' Institute then in session. This was followed by a trip about the campus of the university with visits to the observatory, engineering, physics and research exhibits, and the museum. In the evening Dr. Edgar L. Hewett of Santa Fe gave an illustrated lecture upon "Native American artists" to a joint meeting of the Arizona Archeological and Historical Society with the Southwestern Division. This was followed by a reception in the museum and an exhibit of wireless telephone.

On Saturday morning the three sections were in session simultaneously throughout the morning, except that at 11 o'clock a business meeting was held in which Dr. D. T. MacDougal was elected president of the division for the coming year, and Dr. A. E. Douglass was elected a member of the executive committee. A Yaqui Indian dance was presented in the Yaqui village near Tucson from 2 to 4 in the afternoon, followed by visits

to the Desert Laboratory of the Carnegie Institution and to the Mission of San Xavier near Tucson.

The visiting members were entertained at lunch by the University of Arizona on Thursday in the new Maricopa Hall. They were also entertained at lunch on Friday by the Tucson Chamber of Commerce, at which the Mexican representatives and Dr. Ward were introduced and made addresses.

On Thursday evening a Sigma Xi banquet was held with Dr. Ward and the Mexican representatives as guests of honor.

The executive committee met each morning at 9 and held its final session on Saturday morning. Resolutions were passed in favor of the limitation of the use of radium in the form of radiolite. The next meeting was decided to be held in Santa Fe, New Mexico, September 11-14, 1922.

In arranging the program of this Tucson meeting the special effort was made to give to each section a certain amount of exclusive time during which its papers of widest interest could be presented. This was followed by simultaneous meetings of the sections at which the more technical papers were given, thus assuring abundant time for all papers. The program had been prepared by Dr. V. M. Slipper, chairman of the physical science section, Dr. C. T. Vorhies, chairman of the biological science section, and Dr. E. L. Hewett, chairman of the social science section in conjunction with the president.

On January 29 an ecological excursion was made to the Tucson mountains and lunch was served near the petrified trees, recently discovered by Dr. Sarle, of the University of Arizona.

ABSTRACTS

Chemistry

Flagstaffite, a new Arizona mineral, and its identity with terpin hydrate: F. N. GUILD. Dr. A. E. Douglass discovered on buried logs near Flagstaff, Arizona, a finely crystallized substance whose chemical and crystallographic analysis resulted in its determination as a new organic mineral with the formula $C_{10}H_{22}O_8$. This was named Flagstaffite. Afterwards a communication from Dr. Francis Dodge of Brooklyn led to the further conclusion that flagstaffite is identical with terpin hydrate, a substance easily synthesized in the laboratory, but hitherto never found occurring naturally. The author emphasizes the importance in chemical research of accurate crystallographic measurements, pointing out that in this case, the identity of flagstaffite with terpin hydrate was established largely through crystallographic data.

Demonstration of the Goldschmidt crystal model machine: F. N. GUILD.

The ionization of strong electrolytes in the light of recent theory: T. F. BUEHRER. The author sets forth that an explanation of the anomaly of strong electrolytes as evidenced by their failure to obey the Ostwald dilution law must be sought for in the arrangement of electrons within the molecule, according to the Lewis theory of molecular structure. It also demands a more rational definition of the idea of dissociation of an electrolyte. Various tables showing the activity-coefficients and ionization-constants of potassium chloride, a typically strong electrolyte, and acetic acid, a typically weak one, were given for illustration.

Critical solution temperatures of white phosphorus: T. F. BUEHRER. The theory of solubility worked out by Professor Hildebrand of the University of California is discussed and illustrated by a table, showing the varying conditions of solutions of white phosphorus in different substances.

The development of the tungsten lamp: PAUL CLOKE.

Some new beryllium alloys; their preparation and properties: M. G. FOWLER. Beryllium is a rare element and difficult to separate from Al. It resembles Al, but is lighter and has greater tensile strength. Experimenting on methods of preparation, it was first attempted to electrolyze beryllium into molten lead from fused $BeF_2 \cdot NaF$; and then into mercury from an aqueous solution. In the first case, beryllium was found to be sparingly soluble in lead; and in the second case the amalgam was readily decomposed by water. However, since a pure alloy of beryllium was required, electrolysis was abandoned as unsuccessful. Then oxides of copper and beryllium were reduced in the electric furnace and an alloy containing considerable carbide was obtained, and a similar reduction of BeF_2 with an excess of magnesium produced an alloy of Be and Mg. This method promises more success. The intention is to study phase rule diagrams of alloys of beryllium with copper, aluminum, magnesium, cadmium and zinc.

The potential of the gold electrode: F. S. WARTMAN. The present values of the potential of the gold electrode—the measure of its tendency to pass from the metallic to the ionized condition—are found in error, due to the effects of variations in the physical form of the metal, temperatures and solutions of very soluble salts used by previous investigators. The present work

undertakes to eliminate these sources of error by the measurement of the cells:

(1) Au, AuCl, KCl, (XM), AgCl, Ag.

(2) Au, AuCl, HCl (XM), H₂ (1 atom.)

The direct value obtained for the second cell will be checked by an indirect method which employs Cell (1). Cells employing Au₂O in KOH solution are also being measured.

A study of some unusual habits of wulfenite: F. S. WARTMAN. This paper briefly discussed an extremely flat third order pyramid found to be somewhat common on wulfenite crystals in the Southwest. It is characteristic, although its symbol varies from 1-7-75 to 1-7-98. Another unusual crystal having the prism faces well developed was also described.

A study of the catalytic effect of metallic copper upon the evolution of hydrogen from acids by base metals: DOROTHY G. ANDREWS.

Geology

Sketch of the geology of the Dos Cabezas Mountains of southwestern Arizona: C. J. SABLE. The range is described as a homoclinal fault-block structure, dipping southwestward, with northwest-southeast trend, about 25 miles long, with greatest width midway of nearly 10 miles and maximum height of approximately 8,300 feet in the centrally situated twin peaks from which it takes its name. Residuary piedmont gravel slopes incline away from the range to the broad waste-filled Sulphur Springs valley on the southwest, and to the similar San Simon valley on the northeast. The Dos Cabezas range forms a common orogenic structure with the larger Chiricahuas to the south. The relations and character of the formations and structures reveal a history extending back, possibly to Archean time, and seem to show four periods of mountain making; two pre-Cambrian, and distinctly batholithic; one at the close of the Paleozoic, of marked warping, and possibly with faulting; and a fourth of marked volcanicity and profound faulting, with some batholithic intrusion. The last produced the present Dos Cabezas range. The first three were followed by planation and subsequent sedimentation. Tertiary erosion developed a rock pediment and piedmont gravel slopes, mature dissection extending to the heart of the range. In turn Pleistocene erosion deeply sculptured the piedmont area. The sedimentaries include a heavy, pre-Cambrian quartzite, Cambrian including an upper limestone member, Ordovician (Beekmantonian), Mississippian, Pennsylvanian, Comanchean (with marine leaf), Tertiary piedmont gravels and recent alluvials

(fan and stream flat deposits). (Preliminary and with permission of the director of the Arizona Bureau of Mines).

Astronomy

The application of spectrum analysis to studies of the planets: V. M. SLIPHER. A discussion of the use of the spectroscope in studying rotation and motion of the planets and the constitution of their atmospheres. Evidence of water vapor in the atmosphere of Mars was presented.

Martian polar rifts: G. H. HAMILTON. A discussion of rifts in the polar cap of Mars, observed during the successive oppositions of 1916, 1918, and 1920; and accompanied by lantern slides of drawings illustrating rifts. The belief was expressed that these rifts confirm Lowell's contention that there is vegetation on Mars, since it is assumed that they are caused by the heat given off from growing vegetation. This conclusion is drawn from the apparent similar condition produced on the earth by vegetation growing under the snow.

Methods used at the Lowell Observatory in studying Mars and other planets: E. C. SLIPHER. The technique of astronomical photography was explained. The necessity for enlarging the image, correcting for chromatism with the yellow filter, and using specially sensitized plates was pointed out. The speaker also discussed the time exposure necessary, which varies from one third of a second to 25 or 30 seconds. In closing, it was declared that if due allowance be made for the limitations of the two methods, each is useful as a check on the other.

Progress in photographic observations of nebulae with the 40 inch Lowell reflector: C. O. LAMP-LAND. The modern telescope has increased greatly the number of stars and nebulae, and dark nebulae have also been identified. Among astronomers considerable difference of opinion exists as to the depth of our stellar galaxy, some placing its greatest diameter at 300,000 light years; others at about one fifth of that. It was pointed out that spiral nebulae may be stellar systems—'island universes'—outside our own galaxy. Various arguments for and against the 'Island Universe' theory were offered, among the former being the discovery by V. M. Slipher in 1912 of high space velocity and axial rotation. Yet, despite these high space velocities, their proper motion is very small. Also, their spectrum differs from the spectra of the stars in our system, it resembling the coalesced light of many stars at such great distances that the light of one star can not be dis-

tinguished from the others. An argument against the Island Universe theory was drawn from a series of photographs of a spiral nebula, taken over a space of five years and showing marked changes in the nebula from year to year. It was argued that changes in a whole universe so marked as to be plainly visible at such enormous distances, and occurring within the time space of five years, would be very extraordinary. A similar argument was found in the prominence of the central star in spirals.

A recording micrometer: A. E. DOUGLASS. A description and demonstration of a portable micrometer, which records its readings directly to scale on cross section paper. This instrument was developed in connection with researches on the rings of trees and their relation to climatic cycles, but can be used equally in telescopes.

The spectrum of the night sky and of the aurora of May 14, 1921: V. M. SLIPHER. In observations made by the author, the auroral line is easily determined in the spectrum of the night sky. It shows up at Flagstaff even on cloudy nights. Careful observations made there determined the wave length of the auroral line to be 55.78 instead of 55.71, the previously accepted value. This new value shows a further departure from any known substance than does the old. The auroral line shows in the spectrum, no matter what part of the heavens the camera is pointed at; it is, however, weakest near the zenith. Lord Rayleigh, the great English scientist, is now at work upon this problem of the auroral line in the spectrum, the object of this study being to gain additional information concerning the upper limits of the earth's atmosphere. The work of Dr. Stuerman, a Norwegian scientist, who has spent many years in the study of auroral phenomena, shows that most of the auroral streamers take place about 100 kilometers above the earth's surface, but some are as high as 500 kilometers. If we can learn what the auroral line corresponds to, our knowledge of the upper limits of the earth's atmosphere will be greatly increased. The author showed many photographs taken with a hand camera, of the remarkable auroral display of May 14, 1921, the most brilliant ever noted at the Lowell Observatory.

Observations on the magnetic storm of May 14, 1921: WILLIAM CULLOM. Mr. Cullom described briefly the U. S. Magnetic Observatory and the appliances used, noting especially the variometers which records the horizontal and vertical intensity of the earth's magnetic field. He discussed quiet

days—or days of normal magnetic activity—and disturbed days—or days of magnetic disturbance; and exhibited a typical variometer record of each. He described how the great magnetic storm of May 14, 1921, was preceded by a violent preliminary disturbance and the storm proper was divided into three phases—one from 6 P. M., May 13, to 4 A. M., May 14; another from 3 P. M., May 14, to 2 A. M., May 16; and the third from 3 P. M., May 16, to 5 A. M., May 17. The two last were about equal in violence; the first was less violent than the other two.

Report of a daylight meteor seen in Prescott, Arizona: MILTON UPDEGRAFF. The author mentioned a report which reached him in the spring of 1921 of a meteor which passed over Prescott from the east to the west, and of such brilliancy that it was plainly visible about noon. He himself did not see it, but was told of it by several reliable people. Later reports reached him which led him to believe that the meteor struck in the neighborhood of the Harevar Mountains, in Mohave County, somewhat southwest of Prescott, and 30 or 40 miles from the California line. He mentioned the advisability of having a search made of that region, to try to find some traces of the meteor on the place where it struck.

Biological

The preservation of natural areas in the national forests: G. A. PEARSON. The writer was requested by the chairman of the Committee of Preservation of Natural Areas of the Ecological Society to list the areas of the national forests of Arizona and New Mexico where plant and animal life and natural features in general may remain undisturbed by human activities. Within these two states are 15 natural forests whose combined area is nearly 22 million acres. Under the existing methods of management it is interesting to consider whether the national forests will answer the requirements for "natural areas." The general policy governing the handling of national forests is that of highest use to the public. The primary purpose is the production of timber and associated with this is the utilization and development of grazing, agriculture, water, mining, recreation and other resources. One or two areas, even though of large size, would probably not represent a sufficient variety of conditions to satisfy foresters and botanists. Their needs could be met by selecting small supplementary areas of from 80 to 640 acres.

The relation of research to agriculture: D. W. WORKING. A reaffirmation of the necessity for

research in agriculture looking toward increased production even at the present time when there seems to be an overproduction along many lines; but also, a plea that agricultural research workers broaden the field of their endeavor, and work out new methods of farm management and marketing, in order to enable farmers to dispose of their products more readily and at a fair profit.

A study of the grasses of Arizona: J. J. THORNBUR. This paper includes a study of the 260 species of grasses of Arizona with comparisons of the grass floras of New Mexico and Colorado. The grasses of northern and southern Arizona were compared in numbers, species and the origin of species, typical species of these two grass floras being noted. The grass flora of Arizona was stated to consist of 55 per cent. of southern and southwestern species, 25 per cent. of northern species and 20 per cent. of introduced species. The largest genera of grasses in Arizona in order of number of species are as follows: *Muhlenbergia*, 23; *Panicum*, 19; *Bromus*, 19; *Bouteloua*, 14; *Sporobolus*, 12; *Aristida*, 10.

Forces concerned in the enlargement of cells during growth: A new artificial cell: D. T. MACDOUGAL. The protoplast in its earlier stages is a solid cylindrical or globoid mass of jellies. Enlargement or growth in this stage is by the addition of new material and its swelling by the imbibition of water, which constitutes growth by *accretion*. The formation of cavities or vacuoles in the protoplasm filled with substances which attract water sets up osmosis which pulls in additional water and causes a stretching or enlargement of the entire mass, which is designated as growth by *distension*. The protoplasmic mass was described as including all substances in the cell which may take the form of a reversible gel, that is, which liquefies or dissolves in water or by heat, and which sets or solidifies at low temperatures or on dehydration.

The course of growth of potato tubers: D. T. MACDOUGAL. The growth of potato tubers has been followed in 22 examples measured at Carmel, California, by means of the auxograph. A diagram exhibited showed the course of enlargement of the tuber during its development which might cover a period of 60 to 80 days. The highest rate of enlargement of diameter of the tuber was in its earliest stages when it was less than one cm. in diameter. The highest rate of increase in volume, however, ensued at a much later stage, when the tuber had reached perhaps three fourths of its final size.

An ecological system of plant relationships: EDITH CLEMENTS. This is an account of the application of ecological principles to the evolution of flowering plants, as exemplified in the Besseyan system. The evolutionary processes are assumed to be insect-pollination and wind-pollination, and to have brought about fundamentally similar results by divergent methods.

Changes of climate and life in the Southwest: FREDERIC E. CLEMENTS. A comprehensive attack upon the problems of climatic cycles in the Southwest has disclosed a large amount of evidence drawn from various sources. The most direct evidence has been obtained from weather records of rainfall, in following up the clue afforded by Douglass's studies of tree rings in this region. The operation of larger cycles is indicated in land-forms, such as shore-lines, bajadas and dunes, but is seen with especial clearness in vegetation. This is particularly true of the Mohave Desert and the Santa Cruz valley at Tucson, in both of which grassland communities exhibit cyclic changes in harmony with those found elsewhere in the West.

An improved form of the quadratograph: GORM LOFTFIELD. The Hill quadrat pantagraph has been greatly improved in the past year. These modifications are described, and the apparatus demonstrated. In addition, the present system of staking and photographing quadrats is discussed briefly.

Influence of texture on the limit for black alkali: C. N. CATLIN. Wheat, barley, milo maize and hegari were grown in soil so compounded from actual field soils as to contain 0.20 per cent. sodium carbonate, the only variable being texture, which ranged from heavy clay to high sand. A table of weights of crops shows the maximum growth in the finer textured soils at this "black alkali" concentration.

The effect of intercultural practices on temperatures and humidity in citrus orchards: F. J. CRIDER. Comparative meteorological data obtained from adjoining cover-cropped and cleanly cultivated citrus orchards in the Salt River Valley of Arizona showed that the mean soil temperature of the cover-cropped orchard one foot below the surface was two degrees higher during winter and eight degrees lower during summer than the cleanly cultivated orchard. It was further shown that the mean minimum atmospheric temperature of the cover-cropped orchard was three degrees lower during winter, and the mean maximum

atmospheric temperature seven degrees lower in summer than the cleanly cultivated orchard. Humidity and evaporation records revealed equally valuable data in that the humidity of the cover-cropped orchard for a period of six months was 12.44 per cent. greater and the evaporation 33 per cent. less than the cleanly cultivated orchard. These temperature, humidity and evaporation relationships have a distinct economic bearing in suggesting the avoidance of cover crops in citrus orchards during winter as a means of preventing cold injury, and in indicating the value of such crops in equalizing the environmental factors of the citrus plant.

Physical and chemical factors in the growth of asparagus: E. B. WORKING. Observations on the great asparagus plantations of the Sacramento islands were brought to bear on the particular problems being studied. Charts shown included growth curves illustrating particularly the relation of temperature to growth rate. Reactions to chemical environment, as indicated by hydrations under the MacDougal precision auxograph, were discussed.

Distribution of Arizona wild cotton (Thurberia thespesioides): H. C. HANSON. A summary of all information on distribution and abundance of the wild cotton and the wild boll weevil. Present knowledge shown to be inadequate. (Paper will be published as a bulletin of the Agricultural Experiment Station of the University of Arizona.)

The native wild cotton bollworm, Thurberiphaga catalina Dyar, and its relation to cotton cultivation: C. T. VORHIES. The *Thurberia* bollworm is the larva of a native noctuid moth, recently described, and known only in Arizona wild cotton, *Thurberia thespesioides*. In its larval stages it is a destructive bollworm of wild cotton. A study of its life history now in progress has shown that it can complete its larval life in the bolls of cultivated cotton and it is therefore a potential pest of that crop. Further observations will be made to determine its adaptability to field conditions of cultivated and irrigated land. Restriction of cotton cultivation to areas non-adjacent to wild cotton is a desirable precaution.

Some observations of alfalfa girdle: FREDERICK GIBSON. A disease of economic importance to alfalfa growers of the Southwest, which was first noticed and recorded in 1909, by Freeman and McCallum. No description of symptoms have been previously published. Osborn mentions a girdle of alfalfa, due to a Membracid (*Strictocephala* sp.). The complete paper with illustra-

tions has been accepted by the Phytopathology publishers and will soon be distributed.

The use of cat tail (Typha latifolia) as a feed: L. E. FREUDENTHAL. In a feeding experiment with forty Duroc-Jersey pigs the writer demonstrated on his own farm that cat-tail (*Typha latifolia*) is a satisfactory feed. Its feed value, composition and possible economic importance are discussed.

Suppression of molds during the incubation of certain parasitic fungi: R. A. STUDHALTER. The suppression of molds during the incubation in a saturated atmosphere of certain parasitic fungi in vitro may be accomplished by treating with certain chemicals. Powdered sulphur, various concentrations of mercuric chloride, formaldehyde and copper sulphate, and the use of a dry atmosphere are effective during the incubation of *Pestalozzia* sp. on the needles of *Pinus radiata*, particularly if the chemicals are applied after one to four days of presoaking of the infected needles in water. In the controls the molds appeared to the unaided eye more than five days before the *Pestalozzia* tendrils were pushed through the ostioles; after the treatments mentioned, this advantage of the molds was reduced, the tendrils appearing after some of them from one to five days before the molds. The mycelial growth of the molds was also retarded to a greater extent than was the development of the *Pestalozzia*. No chemical or treatment was found which is able to suppress the molds without seriously hindering the proper development of *Lophodermium* sp. on the needles of *Pinus radiata*, in part probably because the open and more exposed fruiting body of this fungus permits the easy and rapid penetration of toxic agents.

An undescribed fungus on the pepper tree: J. G. BROWN. The pepper tree (*Schinus molle*) grown as an ornamental in the warmer parts of the Southwest, is attacked by a fungus which causes extensive rotting of the wood, eventually resulting in death. Symptoms are gradual death of the branches, or sudden death of the entire tree preceded by wilting. The latter symptom is likely to occur during the hot dry summer months. It is due to the growth of the mycelial hyphæ in the tracheæ. In the case of gradual death of the branches, sporophores appear on the trunk or on branches during the summer rainy season. The sporophores are bracket-like, brown to almost black, azonate, annual, and they usually have a maximum breadth of 12 to 15 cm. The pores are hexagonal to subcircular, occasionally

elongate. The context is brown and is continued into the trama unchanged. Spores are light-brown, oval. The name *Inonotus Schini* n. sp. is proposed. The infection results from frost and wind storm injury and from improper pruning methods. Histological studies indicate that the fungus has few if any new features in connection with the development of the club and the basidio-spores.

Some aspects of the use of the annual rings of trees in climatic study: A. E. DOUGLASS. The ring is primarily a climatic effect. Surplus rings, which are rare, come from too great seasonal emphasis. Missing rings come mostly from excessive dryness of climate. These errors are readily located by comparing many trees together from the same region. The number of trees so far used is about 450 and the number of rings whose date of growth has been identified is over 100,000. The sequoias of California carry an excellent record for more than 3,200 years. The growth of dry climate trees depends on the topography which controls their water supply. Automatic measuring instruments and an analyzing instrument have been constructed. In dry climates the trees show variations which match the rainfall with remarkable exactness. In certain wet climates they show variation that corresponds to the solar activity as denoted by the number of sunspots. The sunspot cycle of 11 years is very common, together with its multiples, 22 and 33 years. The rings of trees are now giving us important information in the chronology of the prehistoric ruins of the Southwest.

The life history of a pine tree as read from a longitudinally bisected trunk: FORREST SHREVE. A vigorous individual of *Pinus radiata* 38 years of age was felled and the trunk cut away so as to expose a median longitudinal section. Transverse sections were taken at intervals of one meter. The annual rings were then identified and dated in each cross section, using the longitudinal surfaces to confirm the dating. Measurements of the individual rings were made at each of the transverse sections, showing a very considerable irregularity in the thickness of the layer of wood laid on in any one year at different heights on the trunk. The period of most rapid growth in height and diameter was between the ages of 7 and 14 years and between the heights of 3 and 8 meters. There is a tendency for the growth in diameter to be greater toward the top of the tree than toward the base. There was a marked slackening in growth rate after the

thirty-fourth year. Double rings of growth are frequently formed in a single year, due to the resumption of growth in the autumn, and they can usually be readily distinguished from the growth rings of successive years. The autumnal thickening also varies with height and is sometimes recognizable at certain heights and apparently absent at others. The results indicate that in *Pinus radiata* a true measure of the annual growth performances should be based on several cross sections at different heights and not on data from the stump section alone.

Effect of tree transpiration on the ground-water table: G. E. P. SMITH. Some efforts made primarily to determine output of groundwater supply through transpiration seems to offer a new method of learning much concerning the quantity and character of transpiration of phreatophytes. Output method of measuring safe annual yield of groundwater useless without knowledge of transpiration of forests and botanical literature silent on this subject. Investigations began in 1916 but discontinued until 1921. Full year's record in 1921 in mesquite forest and in cottonwood forest. Well pits excavated in selected locations and equipped with water-stage recorders of two types. Movements of water table in winter very slight, but correlate closely with daily barometric cycle and with approach and departure of storms. Budding period shows little effect but, after leaves start, draught on groundwater very pronounced. Daily cycles in fair weather uniform, and of two parts—the daily transpiration curve and nocturnal recharge curve, with very little lag. Effects of cloudiness, rains, warm evenings and other conditions plainly marked. Transpiration from mesquite forest almost ceased in August due to disease of trees which caused defoliation, but became rapid again in October after growth of new leaves.

Changes in the composition of Salton Sea with an interpretation: A. E. VINSON. The series of annual analyses showed that CaCO_3 had not concentrated as rapidly as total solids. This loss took place as a deposition of tufa. Phosphorus practically disappeared from the water and an analysis of the tufa showed that this may have been deposited with the tufa. Potassium has not concentrated as rapidly as sodium but the potassium in the tufa would account for not over three per cent. of that lost. The conclusions drawn are that most of the potassium had been absorbed in the heavy mud deposits to be seen on the shores.

Medical

Observations on non-surgical drainage of the liver and gall-bladder: ELLIOTT C. PRENTISS. The emptying of the liver and gall-bladder by means of the duodenal tube, whose tip is at, or just below, the papilla duodenalis, after a solution of MgSO_4 has been injected into the duodenum, is the subject dealt with in this paper. The Refuss tip is used, as it is heavy enough to drag the tube to the pylorus after insertion into the stomach, and the openings in it are large and well placed. It is easily swallowed and requires an average of one to one and one half hours to pass into the duodenum. Condition of patient causes some variations in this time interval and passage in some cases is impossible. With tube in position run in 15 per cent. to 30 per cent. MgSO_4 , using one ounce at a time, and allow to remain five minutes. Therapeutic results are satisfactory in conditions such as chronic cholecystitis even when gall stones are undoubtedly present. Valuable for treatment of gall-bladder infections—such infections as usually progress to formation of gall stones and other complications ultimately requiring operations. Thus, by repeated drainage of liver, cures are frequently obtained and many operations prevented.

The cause of hay fever in Arizona and the Southwest: DR. SAMUEL H. WATSON and DR. CHARLES S. KIBLER. This paper presents the results of the first research work ever done as to the cause of this disease in this section of the country—a complete list of all the plants which grow here, that can possibly cause the disease, is given, and the relative importance of the various plants as a cause is indicated.

Radium, its actions on human tissue cells: W. WARNER WATKINS. The discovery of, and developments in connection with, radium, represent one of the best illustrations of cooperative work of different branches of science. In these branches the applications of radium by the medical sciences is the most interesting. To understand radioactivity, the fundamental structure of the atom must be borne in mind and the phenomenon of ionization. Of the different particles discharged by disintegration of radium atoms, the alpha particle, which is a positively charged helium atom nucleus, has limited application in medicine, since its penetration into the tissues is so slight; the beta particle, which is a negatively charged electron, is usually filtered out when radium is used biologically, because the gamma

ray, which is a very short wave light ray, is exceedingly penetrating, and ionizes the atoms of the tissue molecules, producing beta rays which are the real therapeutic rays in radium treatments. Radium may be used either to destroy foreign growths in the body tissue, or, by limiting its application, to stimulate the normal cells of glands of the body. This latter effect will, eventually, be the important field of application of radium.

The supply of radium: ARTHUR L. FLAGG. The principal sources of radium are from the ores of carnotite and pitchblende. The carnotite ores of the United States are the largest known deposits of uranium-bearing ores. The carnotite occurs in sandstone as grains or incrustations, usually in irregular lenticular masses which are mined by simple methods. The sorting of the ores entails much waste which can be eliminated with proper care. The total production of elemental radium in the United States since 1913 amounts to about 184.9 grams. Much of this has been exported and a too large amount used as an illuminant on cheap watches and other novelties of short useful life. Mesothorium is a valuable and practicable substitute for radium in making luminous paints and its use should be encouraged in order to conserve the radium for its more legitimate uses in therapeutics and in scientific research.

Archeology and Anthropology

Discovery of three skeletons of the Hohokam race in southern Arizona, a prehistoric desert people of the Southwest: C. J. SABLE. Three human skeletons were recently found near Tucson, buried face down, without reference to direction and without personal belongings, which seem from their associations to be referable to a prehistoric people designated Hohokam by Russell (1905). That the grounds for this reference may be understood the paper describes the culture of these ancient people, stating in substance that they were pueblo dwellers, agricultural, and weavers. The pueblos were built of clay and wattle and often included large community houses. This people cleared land and tilled the soil, wove, used edged stone implements, mainly eolithic in simplicity (little modified by secondary flaking), and were excellent potters, decorating their ware with colored designs which exhibit a high degree of artistic skill. They etched the numerous pictographs so common on rock surfaces near the village sites, and seem to have adhered closely to the practice of cremation, a fact

that gives special interest to the skeletons described. Burial pots are seldom accompanied by personal effects. The published paper will contain a diagnosis of skeletons by some anthropologist. Dr. Edgar L. Hewett stated that the skulls were of cliff dweller type, and that the doliochocephalic shape had been disguised by pressure of the cradle board.

A prehistoric skull excavated near Tucson: ROBERT F. GILDER. The author described objects found in excavating prehistoric ruins west of St. Mary's Hospital, Tucson, Arizona. Special attention was called to a skull uncovered some five and a half feet beneath the surface, under a floor.

Orientation of prehistoric house outlines near Bear Canyon, Tucson, Arizona: H. B. LEONARD and A. E. DOUGLASS. The work was done in 1920-1921. Some five compounds were surveyed and plotted: notes, directions and levels taken. The longest walls point about a dozen degrees to the west of south. This work of mapping and surveying ruins in the southwest should be undertaken by more people with engineering skill. As the material is rapidly disappearing all possible notes should be made so that in the future students may substantiate any claims.

Yaqui ceremonial dances: MRS. PHEBE BOGAN. About two miles northwest of Tucson, Arizona, there is a settlement of some two hundred Yaqui Indians who were driven from Sonora, Mexico, by the Indian wars following the overthrow of Madero in 1913. The ceremonial dances of these Indians, particularly those held during Easter or Holy week each spring since their settlement in this locality, furnishes the material for this paper. Lantern slides showing the dancers, their costumes, and the location of the dances were used to illustrate the talk.

Native American artists: EDGAR L. HEWETT.

Life forms in the pottery decoration of the Pueblo area: KENNETH M. CHAPMAN. The decoration of ancient pueblo pottery is geometric in form, and this geometric treatment is also found in the drawing of life forms. Later types of Pueblo ware were developed in various areas within the Pueblo region. In some of these areas the decoration broke away from the limitations of geometric art. Life forms became more realistic, but were combined with a new and more varied symbolism. Following the Spanish invasion, there appeared a still greater diversity of decorative styles, until now each Pueblo community has its own distinctive decorative art in which various life forms still persist. Of all the

life forms the bird predominates throughout this transition from ancient to modern. •

Progress report in research in Jamez region: WESLEY BRADFIELD. The beginning of a series of excavations and studies in the Jamez culture region in New Mexico was begun in 1921 by the School of American Research. The two sites chosen for the first more intensive study were Un-shagi and Guiseewa—four miles above, and at the site of the old Jamez Mission, near Jamez, Hot Springs. Work in the large burial place was described and tentative plans for the coming season's work. These sites are under the control of, or are owned by the School of American Research.

Some archeological studies in the neighborhood of Flagstaff: L. F. BRADY. The occurrence of pottery fragments and other artifacts at depths varying from four to nearly twenty feet in undisturbed stratified alluvial at the north of Flagstaff, together with the presence of semi-fossilized stumps of yellow pine at similar depths, suggested a method for computing the date of the nearby "small-house" ruins in the neighborhood. The pottery fragments and other articles suggested an early stage in the development of the "small-house" culture, which is perhaps one of the earliest forms of the proto-pueblo culture of the Southwest. Much field work still remains to be done.

A half century of archeological research in the Southwest: PAUL A. F. WALTER.

History and Sociology

Pueblo land tenures in New Mexico and Arizona: R. E. TWITCHELL.

The arms conference at Washington: H. A. HUBBARD.

Some sociological characteristics of the Southwest: FRED D. MERRITT.

Beginning of representative government in New Mexico: LANSING B. BLOOM. From Rome and Spain, New Mexico received the form of municipal government which she exercised from the founding of Santa Fe, about 1609, down to the American occupation in 1846. Under Spain also she elected deputies to the Cortes of 1810, 1820 and 1822-3. With the coming of Mexican independence, she chose deputies to Durango, Chihuahua, and for twenty-five years to the Congress in Mexico City. And during the same period deputies of her own election served in successive deputations of the territory. New Mexico had received the form of representative government from the outside, but, thrown almost entirely upon her own resources, she made these forms her own by adaptation and use.